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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
10/605,369	09/25/2003	Lloyd G. Burrell	FIS920030011US1	2368

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EXAMINER

MAI, ANH D

ART UNIT PAPER NUMBER

2814

DATE MAILED: 04/04/2005

Please find below and/or attached an Office communication concerning this application or proceeding.

Office Action Summary

Application No.

10/605,369

Applicant(s)

BURRELL ET AL.

Examiner

Anh D. Mai

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-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

- 1) ☒ Responsive to communication(s) filed on 13 January 2005.
- 2a) ☒ This action is **FINAL**. 2b) ☐ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

- 4) ☒ Claim(s) 1-20 is/are pending in the application.
- 4a) Of the above claim(s) 15-20 is/are withdrawn from consideration.
- 5) ☐ Claim(s) _____ is/are allowed.
- 6) ☒ Claim(s) 1-14 is/are rejected.
- 7) ☐ Claim(s) _____ is/are objected to.
- 8) ☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☐ The drawing(s) filed on _____ is/are: a) ☐ accepted or b) ☐ objected to by the Examiner.
Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).
Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).
- 11) ☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

- 12) ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
a) ☐ All b) ☐ Some * c) ☐ None of:
1. ☐ Certified copies of the priority documents have been received.
 2. ☐ Certified copies of the priority documents have been received in Application No. _____.
 3. ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

- | | |
|--|---|
| 1) <input type="checkbox"/> Notice of References Cited (PTO-892) | 4) <input type="checkbox"/> Interview Summary (PTO-413)
Paper No(s)/Mail Date. _____ |
| 2) <input type="checkbox"/> Notice of Draftsperson's Patent Drawing Review (PTO-948) | 5) <input type="checkbox"/> Notice of Informal Patent Application (PTO-152) |
| 3) <input type="checkbox"/> Information Disclosure Statement(s) (PTO-1449 or PTO/SB/08)
Paper No(s)/Mail Date _____ | 6) <input type="checkbox"/> Other: _____ |

DETAILED ACTION

Status of the Claims

1. Amendment filed January 13, 2005 has been entered. Claims 1, 4 and 5 have been amended. Claims 1-20 are pending. None-elected invention, claims 15-20 have been withdrawn.

Election/Restrictions

2. This application contains claims 15-20 drawn to an invention nonelected with traverse in Paper No. 20041006. A complete reply to the final rejection **must** include cancellation of nonelected claims or other appropriate action (37 CFR 1.144) See MPEP § 821.01.

Claim Objections

3. Claims 4-6 are objected to under 37 CFR 1.75(c), as being of improper dependent form for failing to further limit the subject matter of a previous claim. Applicant is required to cancel the claim(s), or amend the claim(s) to place the claim(s) in proper dependent form, or rewrite the claim(s) in independent form.

The limitation of claim 1 includes: a composite layer ...in addition to the barrier layer **between** the aluminum bond pad and the barrier layer. (as shown in Figs. 3 and 4, composite 140 is between aluminum 124 and barrier 130).

However, the limitation of claims 4-6 includes: the composite layer is within the aluminum bond pad and spaced from the barrier layer. (as shown in Figs. 5 and 6, composite 140/40 is formed between the aluminum 124/24 and spaced from the barrier layer 130/30).

These are two different embodiments.

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Therefore, claims 4-6 fail to further limit claim 1.

Claim Rejections - 35 USC § 112

The following is a quotation of the first paragraph of 35 U.S.C. 112:

The specification shall contain a written description of the invention, and of the manner and process of making and using it, in such full, clear, concise, and exact terms as to enable any person skilled in the art to which it pertains, or with which it is most nearly connected, to make and use the same and shall set forth the best mode contemplated by the inventor of carrying out his invention.

4. Claims 4-6 are rejected under 35 U.S.C. 112, first paragraph, as failing to comply with the written description requirement. The claim(s) contains subject matter which was not described in the specification in such a way as to reasonably convey to one skilled in the relevant art that the inventor(s), at the time the application was filed, had possession of the claimed invention.

There does not appear to be a written description of the claim limitation “wherein the composite layer is within the aluminum bonding pad and spaced from the barrier layer” (as recites in claim 4) or “composites layer is interposed between the first and second aluminum layers” (as recites in claim 5) in conjunction with the limitations of claim 1, in the application as filed.

The specification discloses two distinct embodiments and there is no evidence that the two embodiments are intermixed.

Since the matters are new, a reasonable examination of these claims are impossible.

The following is a quotation of the second paragraph of 35 U.S.C. 112:

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The specification shall conclude with one or more claims particularly pointing out and distinctly claiming the subject matter which the applicant regards as his invention.

5. Claim 4-6 are rejected under 35 U.S.C. 112, second paragraph, as being indefinite for failing to particularly point out and distinctly claim the subject matter which applicant regards as the invention.

Claim 4 recites: the semiconductor device of claim 1, wherein the composite layer is within the aluminum bonding pad and spaced from the barrier layer.

While claim 1, lines 7-8, recites: a composite layer ... between the aluminum bond pad (124) and the barrier layer...

When the composite layer forms within the aluminum layer (claims 4 and 5), which means the composite layer is not between the aluminum layer and the barrier layer. (contradicting claim 1).

How can the composite layer be between the aluminum bond pad and the barrier layer and within the aluminum layer at the same time ?

Claims 4 and 5 are not just fail to further limit claim 1 but also contradicting claim 1. Therefore, claims 4 and 5 are indefinite.

Claim Rejections - 35 USC § 103

The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

6. Claims 1, 3, 7-10, 12 and 14 are rejected under 35 U.S.C. 103(a) as being unpatentable over Costrini et al. (U.S. Patent No. 6,187,680) of record.

Costrini teaches a semiconductor device substantially as claimed including:

- a semiconductor base (20);
- at least one copper wiring level (22) on the semiconductor base (20);
- a barrier layer (28) having a first thickness on, and in direct contact with the copper wiring level (22);
- an aluminum bond pad (30) on the barrier layer (28); and
- a composite layer (Ti/TiN) having a second thickness in addition to the barrier layer (28) between the aluminum bond pad (30) and the barrier layer (28) wherein the composite layer comprises refractory metal (Ti) and a refractory metal nitride (TiN). (See Figs. 2-4; col. 3, line 54-col. 6, line 52).

Thus, Costrini is shown to teach all the features of the claim with the exception of explicitly disclosing that the second thickness is greater than the first thickness. The claimed greater thickness do not appear to be critical.

Note that the specification contains no disclosure of either the *critical nature of the claimed the second thickness being greater than the first thickness* of any unexpected results arising therefrom. Where patentability is aid to based upon particular chosen dimension or upon another variable recited in a claim, the Applicant must show that the chosen dimension are critical. *In re Woodruff*, 919 F.2d 1575, 1578, 16 USPQ2d 1934, 1936 (Fed. Cir. 1990).

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Further, a single layer of the barrier layer 28 having a thickness of 300 to 800 Å, while the Al stack 30, comprises at least Ti/TiN/AlCu (composite layer) and an outer most layer of aluminum, having a thickness of 1,000 to 20,000 Å. Thus, the composite layer of at least three layers (Ti/TiN/AlCu) of the stacked layer 30 is more than likely be thicker than a single barrier layer to protect the copper wiring from environmental attack, test methodologies and/ or reactions with the packaging materials.

Therefore, it would have been obvious to one having ordinary skill in the art at the time of invention to form the

With respect to claim 3, the composite layer (Ti/TiN) of Costrini is directly on the barrier layer (28).

With respect to claim 7, the barrier layer (28) of Costrini is selected from the group consisting of tantalum nitride, tantalum nitride/tantalum and tantalum nitride/titanium/titanium nitride.

With respect to claim 8, the thickness of the barrier layer (28) of Costrini is 100 to 1500 Å which includes the claimed range.

With respect to claim 9, the refractory metal of the composite layer of Costrini is selected from the group consisting of titanium and the refractory metal nitride of the composite layer is selected from the group consisting of titanium nitride.

With respect to claim 10, the thickness of the aluminum bond pad (30) of Costrini is 0.1 to 2.0 μm.

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With respect to claim 12, the refractory metal of the composite layer (28) of Costrini is titanium and the refractory metal nitride is titanium nitride.

With respect to claim 14, since the composite layer (triple layers) of Costrini is more likely be thicker than the barrier layer, thus, obviously having a thickness that includes the claimed range.

7. Claims 2 is rejected under 35 U.S.C. 103(a) as being unpatentable over Costrini as applied to claim 1 above, and further in view of Merchant et al. (U.S. Patent No. 6,410,986) of record.

With respect to claim 2, Costrini teaches a composite layer comprises alternating layers of refractory metal (Ti) and refractory metal nitride (TiN).

Thus, Costrini is shown to teach all the features of the claim with the exception of explicitly disclosing that there are at least two layers of each refractory metal and refractory metal nitride.

However, Merchant teaches forming multi-layer structure to eliminate un-wanted diffusion of aluminum including: a composite layer comprises alternating layers of refractory metal (88) and refractory metal nitride (86) and there are at least two layers of each of the refractory metal (Ti) and refractory metal nitride (TiN). (See Fig. 5).

Therefore, it would have been obvious to one having ordinary skill in the art at the time of invention to form the composite layer of Costrini comprises at least two layers of each of the refractory metal and refractory metal nitride as taught by Merchant to eliminate un-wanted diffusion of aluminum.

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Furthermore, It has been held that *mere duplication of the essential working parts* of a device involves only routine skill in the art. *St. Regis Paper Co. v. Bemis Co.*, 193 USPQ 8.

8. Claims 11 and 13 are rejected under 35 U.S.C. 103(a) as being unpatentable over Costrini as applied to claim 1 above, and further in view of Besser et al. (U.S. Patent No. 6,239,494) of record.

Costrini teaches the refractory metal and refractory metal nitride comprises Ti and TiN, respectively. Thus, Costrini is shown to teach all the features of the claim with the exception of alternatively using other refractory metal and refractory metal nitride.

However, Besser teaches it is well known in the art to use other refractory metal and refractory metal nitride such as Ta, W, TaN and WN, respectively, in place of Ti and TiN.

Therefore, it would have been obvious to one having ordinary skill in the art at the time of invention to alternatively using tantalum and tungsten and a nitride of these refractory in place of Ti and TiN of the Costrini as taught by Besser since these metal and their nitride have a similar characteristic of preventing diffusion of aluminum.

Response to Arguments

9. Applicant's arguments with respect to the pending claims have been considered but are moot in view of the new ground(s) of rejection.

Conclusion

10. Applicant's amendment necessitated the new ground(s) of rejection presented in this Office action. Accordingly, **THIS ACTION IS MADE FINAL**. See MPEP § 706.07(a). Applicant is reminded of the extension of time policy as set forth in 37 CFR 1.136(a).

A shortened statutory period for reply to this final action is set to expire **THREE MONTHS** from the mailing date of this action. In the event a first reply is filed within **TWO MONTHS** of the mailing date of this final action and the advisory action is not mailed until after the end of the **THREE-MONTH** shortened statutory period, then the shortened statutory period will expire on the date the advisory action is mailed, and any extension fee pursuant to 37 CFR 1.136(a) will be calculated from the mailing date of the advisory action. In no event, however, will the statutory period for reply expire later than **SIX MONTHS** from the date of this final action.

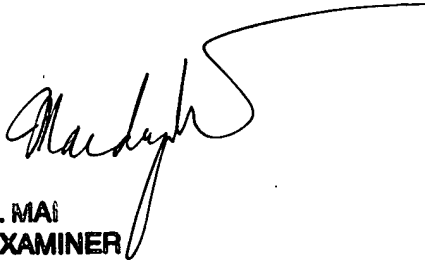
Any inquiry concerning this communication or earlier communications from the examiner should be directed to Anh D. Mai whose telephone number is (571) 272-1710. The examiner can normally be reached on 9:00AM-5:00PM.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Wael Fahmy can be reached on (571) 272-1705. The fax phone number for the organization where this application or proceeding is assigned is 703-872-9306.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR

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system, see <http://pair-direct.uspto.gov>. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free).

A handwritten signature in black ink, appearing to read 'Anh D. Mai', with a long, sweeping horizontal line extending to the right.

ANH D. MAI
PRIMARY EXAMINER

March 31, 2005